Jiro TANAKA* and Mitsuo CHIHARA*: **Taxonomic study of the Japanese crustose brown algae (5) *Endoplura* and *Diplura* (Ralfsiaceae, Ralfsiales)****

田中次郎・千原光雄：日本産殻状褐藻の分類学的研究 (5) エンドプルラ属とディプルラ属 (イソガワラ科, イソガワラ目)

Endoplura Hollenberg, J. Phycol. 5: 298 (1969).

Thallus crustose, flatwise expanded, firmly attached to the substratum; erect filaments firmly adjoined with one another, arised from an indistinct hypothallial layer, usually curving upwards; chloroplasts several to many, discoid or irregular in shape; plurilocular reproductive organ in irregular sori, arised from cells in the subterminal portion of the erect filament, composed of usually two or sometimes four plurilocular reproductive filaments with usually three terminal sterile cells; unilocular sporangia unknown.

Endoplura is a monotypic genus characterized by the following combination of characters: 1) chloroplasts are several to many discoid within a cell, 2) plurilocular reproductive organs are intercalarly borne in the subterminal portion of the erect filaments, with three terminal sterile cells.

According to Hollenberg (1969), *Endoplura* and also *Diplura* probably lack unilocular sporangium, and they have many discoid chloroplasts. Nevertheless, he has assigned these two genera to the Ralfsiaceae, taking up the intercalary position of plurilocular reproductive organ as a primary taxonomic character. Hollenberg (1969) gave figures on which some early stages in the development of germlings from swarmers from plurilocular reproductive organ of *Diplura simulans* were drawn. But no other cultural study has not been carried out for these algae to clarify the life history, so the Hollenberg's systematic treatment is followed in the present work.

Endoplura aurea Hollenderg, J. Phycol. 5: 300 (1969). (Fig. 1, D; Fig.

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2. A-E)

Thallus crustose, expanded, epilithic or epizoic, light to dark brown, almost circular in outline at all stages, but often confluent, attaining to 5 cm or more in diameter, often up to 20 cm as found on the material of Miyagi-ken, 200-700 μm thick, firmly attached to the substratum with its under surface with or without rhizoids, later somewhat free in the medial portion; the surface of thallus fairly smooth; vegetative erect filaments arised from the indistinct hypothallial layers of which cells are 8-12 μm broad and 3-4 times as long as wide, tapering toward the surface, firmly adjoined with one another to form a pseudoparenchymatous tissue; cell of the erect filament containing many granular storage substances, 8-10 μm broad and 1.5-2 times as long as wide; tuft of hairs sparse, arised from the medial part of the thallus; chloroplasts disc-shaped or rather irregularly discoid, located in the upper part of the cell; plurilocular reproductive organs 80-100(-150) μm long, composed of two to four separate reproductive filaments, each consisting of row of spores, with 2-3(-4) terminal sterile cells; unilocular sporangia not observed.

Habitat. Growing on rocks, especially on *Tetraclita* species in the upper litoral zone, particularly in exposed flat surf areas. Sometimes growing mixed with *Ralfsia verrucosa*.

Type locality. Orange County, California, U.S.A.

Geographical distribution. The Pacific coast of lower California, and the middle part of the Pacific coast of Japan.

Representative specimens examined. Choshi, Chiba-ken, May 5, 1966 (TKB 1340); the same, June 4, 1977 (TKB 1341); Shimoda, Shizuoka-ken, Feb. 22, 1973 (TKB 1342); the same, March 4, 1976 (TKB 1343); Kesennuma, Miyagi-ken, June 6, 1977 (TKB 1344); the same, Apr. 25, 1973 (TKB 1345); Hitachi, Ibaraki-ken, June 6, 1978 (TKB 1346).

The present alga agrees very well with *Endoplura aurea* described by Hollenberg (1969) based on the specimens from California. However, there are few differences, though they are all minor. According to Hollenberg (1969), the erect filaments are strictly straight in his alga, but the Japanese alga has upwardly curved vegetative filaments, as in *Ralfsia verrucosa*. Furthermore, Hollenberg has figured four or five terminal sterile cells on the plurilocular reproductive organs in his alga, while in ours terminal sterile cells are always three in number.

This species has the habitat and the size of the crustose expanse, both similar to those of *Ralfsia verrucosa* and, therefore, it is not easy to distinguish these two species by the naked eyes. However, *E. aurea* is golden to light brown in color, whereas *R. verrucosa* is dark brown in color.

Manner in which the reproductive cells develop on germination has been regarded as one of the important criteria to determine systematic position of the algae. The culture of the present alga was therefore undertaken in the laboratory. Cells liberated from the plurilocular reproductive organs germinated and developed into an expanded disc, as shown in Fig. 2, C-E. This was a feature used by Nakamura (1972) as a criterion to characterize the order Ralfsiales. Since Hollenberg (1969) made no cultural study of *Endoplura aurea*, this is the first report as to the early development of this species.

Diplura Hollenberg, J. Phycol. 5: 298 (1969).

Thallus crustose, expanded, firmly attached to the substratum without rhizoids, more or less covered with gelatinous layer; a basal layer composed of several rows of cells; vegetative erect filaments arised from a basal layer, loosely or firmly adjoined with each other, simple or sparsely branched; chloroplasts discoid, several to many per cell; hairs in tuft, frequent, arised from a basal layer; plurilocular reproductive organ in extensive sori, arising from the subterminal cell of the erect filament, composed of two plurilocular reproductive filaments per each vegetative filament, bearing single terminal sterile cell; unilocular sporangium unknown.

Diplura is a monotypic genus, erected by Hollenberg (1969) based on *D. simulans*, and it is characterized as follows: 1) thallus covered with a gelatinous layer, 2) several to many discoid chloroplasts within a cell, and 3) plurilocular reproductive organs composed of a pair of plurilocular reproductive filaments with a terminal sterile cell on each vegetative filament. On the basis of the subterminal position of plurilocular reproductive organs, *Diplura* has been placed in the Ralfsiaceae.

According to Hollenberg (1969), *Diplura* resembles *Mesospora* described by Weber van Bosse (1911) in having gelatinous thalli. However, it differs from *Mesospora* in several respects: *Mesospora* has a single chloroplast per cell and intercalarly uniseriate plurilocular reproductive organs, whereas *Diplura* has many chloroplasts per cell and paired plurilocular reproductive organs in intercalary position

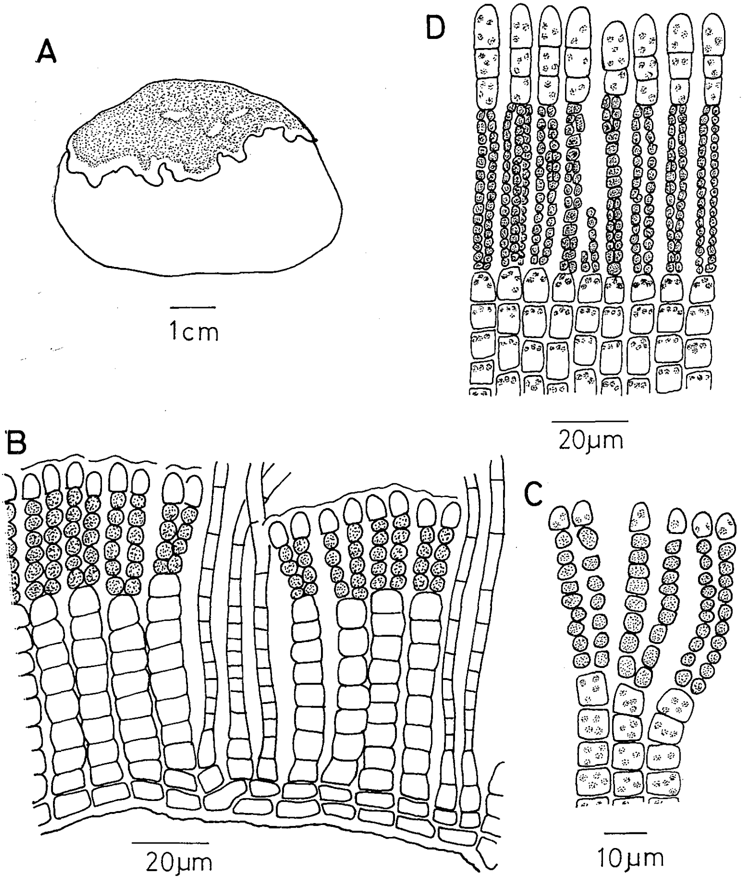

Fig. 1. A-C. ***Diplura simplex***. A. Habit on a pebble showing a broad central reproductive area. B. Cross section of the thallus with plurilocular reprodcutive organs and hairs. C. Several mature plurilocular reproductive filaments, showing several chloroplasts per each cell. D. ***Endolura aurea***. Cross section of the thallus with plurilocular reproductive layer, showing reproductive filaments and sterile cells, and also several chloroplasts per cell.

Diplura is similar to *Endoplura* in many respects, but differs from it as follows: *Diplura* has somewhat a soft thallus and a single terminal sterile cell on the plurilocular reproductive organ, while *Endoplura* has a rigid thalli and three terminal sterile cells. Moreover, the former has large sori which occupy very wide regions, while the latter has many small sori which scatter through

the whole thallus, making many patches.

Diplura simplex sp. nov. (Fig. 1, A-C; Fig. 3, A-E)

Thalli tenues, crustacei, in saxis, atro-brunnei in partibus vegetativis, pallide brunneus in partibus fructiferis maturis, usque ad 1 cm. diam. et usque ad 25 μm crassi; pars basis 2-4 cellulo-stratose; filamenta erecta plerumque, simplicia, 7-8 μm crassa, e 15-25 cellulis compositis; chloroplasti aliquot ad multos per cellulam; organa reproductiva plurilocularia 2 seriata per filamentum erectum, usque ad 60 μm longa, cum 1 cellula sterile terminale; sporangia unilocularia ignota.

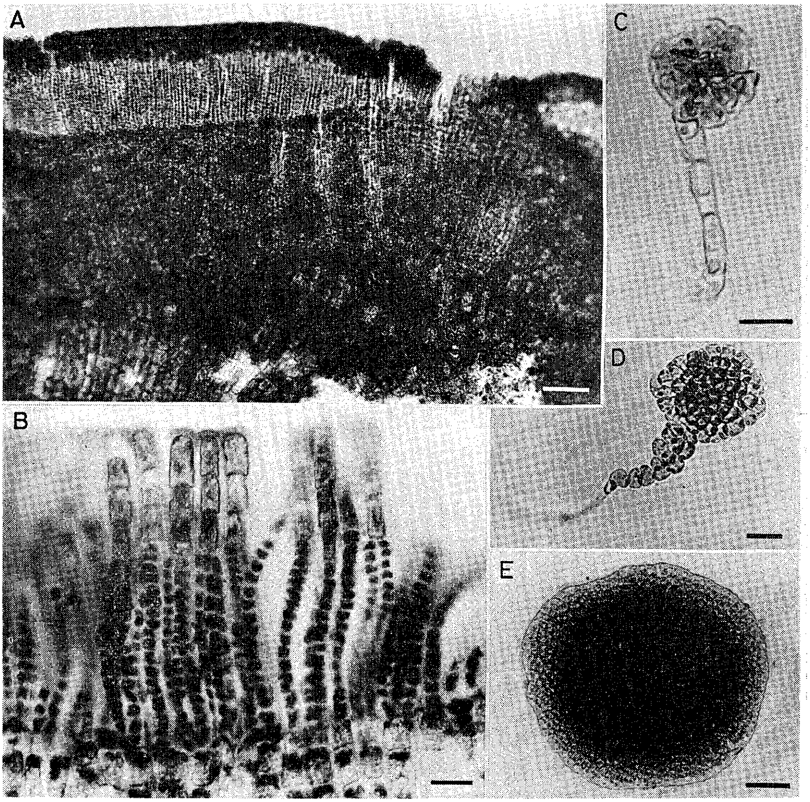

Fig. 2. *Endoplura aurea*. A. Longitudinal section of the thallus with the plurilocular reproductive layer. B. Plurilocular reproductive filaments and sterile cells. C-E. Three germlings derived from cells liberated from the plurilocular reproductive organs. They show a discal type of germination. Scale: A & E, 50 μm; B & C, 10 μm; D, 20 *μm*.

Thallus thin crustose, expanded, epilithic, dark brown in vegetative part and light brown in mature part, circular in outline when young, later becoming indefinite or irregular, often confluent with other thalli, covering over the upper surface of a pebble, attaining a diameter of 5 cm and a thickness of 250 μm, firmly attached to the substratum with its under surface without rhizoids; the surface of thallus smooth, somewhat gelatinous; vegetative thallus composed of a basal layer and an erect filament; the basal layer composed of 2-4 rows of cells, measuring 5-6 μm in height and 1-3 times as wide as high; the erect filament arised from the basal layer, simple, straight, composed of 15-25 cells; cells of the erect filaments 7-8 μm broad and 0.6-1.2 times as long as wide; hairs in tuft, arised from a basal layer, frequent; cells having many granular substances and many disc-shaped or irregularly shaped chloroplasts; sori of plurilocular reproductive organs covering the whole thallus except the marginal part; plurilocular reproductive organs up to 60 μm long, standing in two rows on each erect filament, reproductive filament bearing one terminal sterile cell; unilocular sporangia not observed.

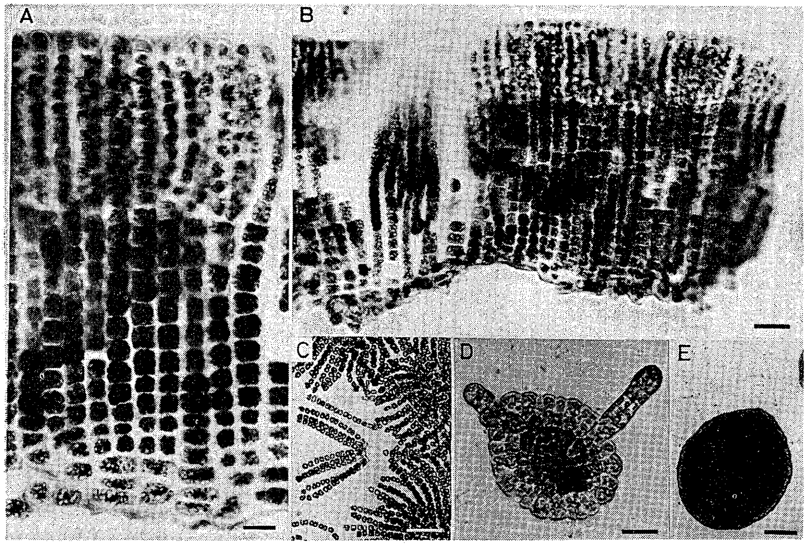

Fig. 3. *Diplura simplex*. A-B. Longitudinal section of the thallus with plurilocular reproductive layer, showing reproductive filaments, sterile cells and a hair pit. C. Nearly mature reproductive filaments separated easily with pressure. D, E. Two germlings derived from cells liberated from the plurilocular reproductive organs. They show a discal type of germination. Scale: A & D, 10 μm; B, 20 μm; C, 50 μm; E, 100 μm.

Habitat. Growing on rocks or pebbles in the middle part of the intertidal zone.

Holotype. Hachijo-jima, Izu Islands; May 23, 1978 (TKB 1350, in liquid).

Representative specimens examined. Shimoda, Shizuoka-ken, Feb. 8, 1979 (TKB 1351); the same, March 19, 1979 (TKB 1352).

It is clear that the present alga belongs to the monotypic genus *Diplura* Hollenberg in the following combination of characters: 1) gelatinous thallus, 2) several chloroplasts per cell and 3) paired plurilocular reproductive organ.

From the result of comparison between our alga from Hachijo-jima and the type specimen of *Diplura simulans*, which was collected from California and was deposited in the United States National Herbarium (USNH 61151), we found the following anatomical differences between them. *Diplura simulans* has a thick and large crust (8-10 cm in diameter, 150-650 μm thick), while our alga has a small and thin crust. In *D. simulans*, the erect filaments are branched, somewhat curved upwardly and readily separated with pressure like as in the member of *Mesospora*, but in our alga, those are simple, straight and not so readily separated. On the basis of these evidences, it is reasonable to recognize our alga as a new species. Therefore, we would propose to give the alga a new binomial *Diplura simplex* after it having simple erect filamets.

There are several distinctive features in *D. simplex*. The reproductive layer broadly expands and covers almost whole thallus, and when mature, it turns yellow and it is apt to be disintegrated from thallus. Cells of our alga contains much of reserved substances which are easily stained with cotton blue. These features may be useful to distinguish *D. simplex* from the other members of the Ralfsiaceae.

The culture of this alga was carried out in the laboratory. In a similar manner as those of the previously described species, cells liberated from the plurilocular reproductive organs gave rise on germination to an expanded disc, which was a feature typical of the Ralfsiales (Fig. 3, D. E). This observation is fundamentally identical with that described by Hollenberg (1969) with *Diplura simulans* from California.

References

Hollenberg, G. J. 1969. An account of the Ralfsiaceae (Phaeophyta) of California. J. Phycol. **5**: 290-301. Nakamura, Y. 1972. A proposal on the clas-

sification of the Phaeophyta. *In* Abbott, I. A. & Kurogi, M. (ed.): Contributions to the systematics of benthic marine algae of the North Pacific. pp. 147-155, Kobe.

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本報告ではイソガワラ科に属するエンドプルラ属の1種 *Endoplura aurea* とディプルラ属の1種 *Diplura simplex* (新種) の記載を行った。

Endoplura aurea は主として次の分類学上の特徴をもち，本邦では本州太平洋沿岸北部から中部にかけて広く分布することが判明した。1) 栄養細胞は数個の葉緑体をもつ; 2) 複室生殖糸は体内に埋まって形成され，体を構成する直立糸上に一般に2本，時に4本できる。それらの頂部には3個連続した大形の不稔細胞が存在する。*Diplura simplex* は八丈島及び伊豆半島沿岸で新たに採集された種で，1) 栄養細胞は数個の葉緑体をもち，2) 体を構成する直立糸上に1対の複室生殖糸が形成され，それぞれの生殖糸は頂端に1個の不稔細胞をもつことでディプルラ属に所属し，既知種 *Diplura simulans* とは 1) 体が薄いこと，及び 2) 直立糸が分枝しないことで区別される。

□唐澤耕司: **原種洋ラン** pp. 221, pls. 128. 1981. 誠文堂新光社，東京. ¥3800. ラン科はイネ科やマメ科と共に種類数でも圧倒的に多いが，花の多型と美麗とでは群を抜いている。まして人工新種でも花中の王者である。本書はどちらかというと野生の原種の美しさにひかれて凡そ200属500種程を集めたもので，これを属を大体分類で並べ，各頁に大体3～4枚適当に配列し，巻尾にその解説を挙げている。大きな属ではたとえば *Dendrobium* 10ページ，*Oncidium* 6ページという具合に，小さな属は1種ずつ（たとえば *Cymbidiella*, *Paphinia* など）拾ってある。写真はカラーで中々美しく，見ていてあきない。索引には種名（変種，亜種名）のも作ってあるのもよい。（前川文夫）

□木村陽二郎: **シーボルトと日本の植物** 恒和選書 5, pp. 235. 1981. 恒和出版，東京. ¥1,400. 著者がケンペルからツュンベリー，シーボルトに及ぶ三人の外人に対してこれに接触して影響を受けたりまた影響を与えたりした日本人とその著作について，ここ10年間に得たものをまとめたものということができる。割合に重複も少ないし，興味を以て読むことができよう。とくに日本最初の植物図鑑といわれる「訓蒙図彙」，伊藤伊兵衛の「地錦抄」，圭介の著わした日本の新らしい植物学としての「泰西本草名疏」の解説と意義とに詳しい。近年大分改めてみとめられつつある近代の日本における植物学の導入と発展の跡を辿るにまことにふさわしい業績というべきである。（前川文夫）